REMARKS

Claims 4, 6, 20-22, 25, 30, and 31 have been amended herein. Claims 1, 4, 6, 20-25, and 30-32 remain pending in the above-identified application.

Section 102 - Claim 32

Applicants respectfully request reconsideration of the rejection of Claim 32 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,357,622 (Magdo). Claim 32 recites a first vertical type bipolar transistor and a second vertical type bipolar transistor having a breakdown voltage that is higher than a breakdown voltage of the first vertical type bipolar transistor.

Magdo discloses a transistor structure having a bipolar NPN and a bipolar PNP transistor. Magdo does not expressly or inherently show a first vertical type bipolar transistor and a second vertical type bipolar transistor having a breakdown voltage that is higher than a breakdown voltage of the first vertical type bipolar transistor.

The assertion made in the Office Action that Magdo inherently discloses a second high voltage transistor having higher breakdown voltage than the first transistor is incorrect for at least two reasons. First, according to M.P.E.P. § 2131.01(III), a rejection based on inherency must include *clear extrinsic evidence* that the missing descriptive matter is *necessarily* present in the reference. The Office Action does not present clear extrinsic evidence that the missing descriptive matter is necessarily present in the reference. The Office Action asserts that because Magdo's structure is identical to the claimed structure, the second transistor is high voltage. However, a showing in the reference of all but the missing element does not necessitate a showing of inherency for the missing element. In other words, even if Magdo did show every element except the second transistor having a higher breakdown voltage than the first, that showing is not enough, alone, to establish that one of skill in the art would determine that the missing element was necessarily present in the reference.

Second, the reasoning presented in the Office Action that the second transistor of Magdo is high voltage because Magdo's structure is identical to the claimed structure, is in error for several reasons. First, claim 32 does not recite a "high voltage

transistor," as worded by the Office Action, but rather recites a first vertical type bipolar transistor and a second vertical type bipolar transistor having a breakdown voltage that is higher than a breakdown voltage of the first vertical type bipolar transistor. Second, the second transistor of the present invention has a higher breakdown voltage than the first transistor at least in part because "the thickness of the collector layer of the first bipolar transistor...is thinner than the thickness of the collector layer of the second bipolar transistor...and the second embedded diffusion layer...has a lower impurity concentration than the first embedded diffusion layer." *See* Specification, page 22, lines 3-11. The claimed voltage characteristic relies at least in part on qualities of the disclosed invention not directly recited in the present claim. Thus, the voltage characteristic is not inherently shown in the reference even if the reference shows every claimed feature except the missing voltage characteristic features.

The Office Action also asserts that the limitation of a second transistor functioning as a high voltage transistor is a functional limitation and an intended use. *See* page 3, lines 12-16. As an initial matter, as stated above, claim 32 does not recite the second transistor functions as a high voltage transistor as the Office Action asserts. Claim 32 recites a second vertical type bipolar transistor has a breakdown voltage that is higher than a breakdown voltage of the first vertical type bipolar transistor. The voltage characteristic is not a functional limitation or an intended use. Breakdown voltage is a physical characteristic of a diode and not a use. The Office Action further asserts that an intended use must result in a structural difference between the claimed invention and the prior art in order to be patentably distinct. *See Id.* at lines 14-16. In addition to not being an intended use, the voltage characteristic results from a structural difference between the claimed invention and the prior art because, as mentioned above, the voltage characteristic results from "the thickness of the collector layer of the first bipolar transistor...(being) thinner than the thickness of the collector layer of the second bipolar transistor...and the second embedded diffusion layer...(having) a lower impurity concentration than the first embedded diffusion layer." *See* Specification, page 22, lines 3-11.

Because the reference does not disclose or inherently contain every element of the claim, the rejection of the claim is improper. Accordingly, Applicants respectfully request the rejection be withdrawn.

Section 103 - Claims 1, 4, 6, 21-23, 25, 30, and 31

Applicant respectfully requests reconsideration of the rejection of claims 1, 4, 6, 21-23, 25, 30, and 31 under 35 U.S.C. § 103(a) as being unpatentable over Magdo in view of U.S. Patent No. 5,151,765 (Yamauchi).

Each of claims 1, 4, 6, 21-23, 25, 30, and 31 recites first vertical type bipolar transistor and a second vertical type bipolar transistor having a breakdown voltage that is higher than a breakdown voltage of the first vertical type bipolar transistor.

Magdo discloses a transistor structure having a bipolar NPN and a bipolar PNP transistor. As shown above regarding claim 32. Magdo and Yamauchi, individually and in combination, fail to show or suggest a first vertical type bipolar transistor and a second vertical type bipolar transistor having a breakdown voltage that is higher than a breakdown voltage of the first vertical type bipolar transistor.

Each of claims 1, 4, 6, 21-23, 25, 30, and 31 further recites a first embedded diffusion layer formed as a part of the collector of the first vertical type bipolar transistor in a first upper part of the substrate and in the epitaxial layer and a second embedded diffusion layer formed as a part of the collector of the second vertical type bipolar transistor directly on the substrate. The Office Action points out that Magdo does not disclose these claim elements. *See* page 4, lines 11-13. The Office Action also attempts to show that claim 1 is obvious because Yamauchi discloses "a second NPN transistor." *See Id.* at 13-20. However, the present claims do not recite "a second NPN transistor." Even if Examiner believes the recitation of "a first embedded diffusion layer formed as a part of the collector of the first vertical type bipolar transistor in a first upper part of the substrate and in the epitaxial layer and a second embedded diffusion layer formed as a part of the collector of the second vertical type bipolar transistor directly on the substrate" is equivalent to "a second NPN transistor," the Examiner must still show that the prior art shows or suggests "a first embedded diffusion layer formed as a part of

the collector of the first vertical type bipolar transistor in a first upper part of the substrate and in the epitaxial layer and a second embedded diffusion layer formed as a part of the collector of the second vertical type bipolar transistor directly on the substrate," as claimed. In an obviousness analysis, "there is no legally recognizable or protected essential, gist, or heart of the invention" and restricting a multi-faceted recital to a single-element recital constitutes error. *See* W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 1548, 220 U.S.P.Q. 303, 309 (Fed. Cir. 1983) and M.P.E.P. § 2141.02.

Further, as motivations for combining Magdo and Yamauchi to show "a first embedded diffusion layer formed as a part of the collector of the first vertical type bipolar transistor in a first upper part of the substrate and in the epitaxial layer and a second embedded diffusion layer formed as a part of the collector of the second vertical type bipolar transistor directly on the substrate," the Office Action refers to benefits of forming a second NPN transistor. *See* page 4, lines 17-24.

According to Section 706.02(j) of the M.P.E.P., "it is important for an examiner to properly communicate the basis for a rejection so that...applicant can be given fair opportunity to reply." Applicants are not given a fair opportunity to reply where the Office Action does not identify the equivalent of most of the claimed elements in the references and claim wording is changed into other wording and the obviousness analysis, including the finding of motivation, is performed in light of the other wording. For example, the Office Action fails to identify what in the Magdo is being considered the "emitter," the "base," the "collector," and "the epitaxial layer." If the Examiner wishes to maintain the rejection, Applicants request the Examiner do so in a non-final Office Action clearly presenting the bases for rejection so that Applicants have a fair opportunity to reply.

Yet further, if Magdo discloses a collector, as inferred in the rejection of the present claim and of claim 32, the issue is whether and why one skilled in the art would be motivated to change the manner that the embedded diffusion layers are formed with respect to the collectors disclosed in Magdo in view of Yamauchi. Magdo discloses collector reach through regions 72, 76, collector contacts 86, 90, and subcollector

regions 22, 38. If Applicants are incorrect in assuming that the Examiner is considering these elements as the collector, Applicants request Examiner issue a new non-final Office Action clearly identifying each claim element in the references. If Applicants' assumption regarding what is being considered the "collector" is correct, then the Office Action is asserting that the collector component 22 is both the claimed collector *and* the claimed first embedded diffusion layer, as asserted in line 14 of page 2. Further, if Applicants' assumption regarding what is being considered the "collector" is correct, it is not clear whether the Examiner intends that it is obvious for the buried layers 2a, 2b of Yamauchi to be formed as a part of the collector of Magdo, for the buried layers 2a, 2b and collector regions 3a, 3b of Yamauchi be implemented in Magdo in addition to the collector and buried layers of Magdo, that the buried layers 2a, 2b and collector regions 3a, 3b of Yamauchi to be implemented in Magdo in lieu of the collector and buried layers of Magdo, or other.

As amended, claim 4 further recites a distance between a location of peak impurity concentration within the second embedded diffusion layer and a location where the second embedded diffusion layer intersects the substrate is less than one-half of a distance between the location of peak impurity concentration and a location where the second embedded diffusion layer intersects the epitaxial layer. The matter recited in claim 4 is not shown, inherent, or suggested in the prior art. The Office Action rejects claim 4 based on the idea that it is well known that diffused areas have concentrations that follow a natural distribution curve, citing Fig. 9, item 22", of Watanabe et al. as an example. *See* page 5, lines 1-8. Applicants are proceeding under the assumption that Examiner is referring to U.S. Patent No. 4,258,379 here and, if Applicants' assumption is incorrect, requests a new Office Action correctly identifying the reference relied on. Again, the Office Action improperly substitutes wording ("diffused areas have concentration that follows natural distribution curve") for the wording of the claim and attempts to reject the claim based on the substituted wording. Although it may be known for diffused areas to have concentrations that follow a natural distribution curve, following a natural distribution curve is not the substance of the claim. If the Examiner wishes to maintain the rejection, Applicants request the Examiner do so in a new non-

final Office Action clearly showing how the claimed substance is shown, suggested, or inherent in the prior art.

As amended, claim 6 further recites that the impurity concentration of the second embedded diffusion layer is between about $1x10^{13}$ and about $1x10^{15}$. Magdo does not show or suggest a second embedded diffusion layer having an impurity concentration between about $1x10^{13}$ and about $1x10^{15}$. The Office Action cites column 4, lines 8-9 of Magdo as disclosing a second embedded diffusion layer having an impurity concentration of 1E13 to 1E15. However, the recitation in these lines refer to a preferred level of *energy use* from about $1x10^{14}$ ions/cm^2 to about $1x10^{15}$ ions/cm^2 and not levels of *impurity concentration* (measured in atoms/cm^3).

As amended, claim 21 further recites an impurity concentration of the second embedded diffusion layer that is approximately equal to or higher than the epitaxial impurity concentration at all depths of the second vertical type bipolar transistor between the surface of the emitter and a position of peak impurity concentration within the second embedded diffusion layer. As with claim 4, the Office Action rejects claim 21 based on the idea that it is well known that diffused areas have concentrations that follow a natural distribution curve, citing Fig. 9, item 22", of Watanabe et al as an example. *See* page 5, lines 1-8. Again, the Office Action improperly substitutes wording ("diffused areas have concentration that follows natural distribution curve") for the wording of the claim and attempts to reject the claim based on the substituted wording. Although it may be known for diffused areas to have concentrations that follow a natural distribution curve, following a natural distribution curve is not the substance of the claim. If the Examiner wishes to maintain the rejection, Applicants request the Examiner do so in a new non-final Office Action clearly showing how the claimed substance is shown, suggested, or inherent in the prior art.

Further regarding claim 21, the matter recited particularly in claim 21 is not shown, inherent, or suggested in the prior art. Regarding the Office Action's inherency assertion, the cited Watanabe reference clearly shows impurity concentrations 22" of the diffused layer 22 that are lower than impurity concentrations of the epitaxial layer at a depth between the surface of the emitter and a position of peak impurity concentration

within the diffused layer. *See, e.g.*, Watanabe, Fig. 9. Thus, Watanabe does not illustrate the claimed elements.

As amended, claim 22 further recites a peak position of an impurity concentration of the second embedded diffusion layer residing at a distance from the surface of the emitter of the second vertical type bipolar transistor that is approximately equal to a distance from the bottom of the first embedded diffusion layer to the surface of the emitter of the first vertical type bipolar transmitter. Magdo fails to disclose or suggest the claimed elements. Figs. 8 and 9 of Magdo show an impurity concentration profile for the PNP and NPN transistors, respectively, that plots impurity concentration levels (Y-axis) against depth (X-axis) from the top of the transistor structure. It is clear from these figures, having the same X-axis scale, that the locations of peak impurity concentration for the respective transistors are substantially the same. Magdo fails to show or suggest a peak position of an impurity concentration of the second embedded diffusion layer residing at a distance from the surface of the emitter of the second vertical type bipolar transistor that is approximately equal to a distance from the bottom of the first embedded diffusion layer to the surface of the emitter of the first vertical type bipolar transmitter, as claimed.

Claim 23 further recites that the first embedded diffusion layer includes an impurity concentration that is higher than the epitaxial impurity concentration. Magdo fails to disclose the claimed elements. Further, Applicants are again not being given a fair opportunity to reply because the Office Action fails to clearly communicate the basis for the rejection. *See* M.P.E.P. § 706.02(j). Specifically, the Office Action does not identify why the Examiner believes that the reference discloses the claimed elements.

As amended, claim 25 recites the second embedded diffusion layer is an N^+-type second embedded diffusion layer and is slightly diffused into a lower part of the epitaxial layer. Magdo and Yamauchi, individually and in combination, fail to disclose or suggest this matter. Note, for instance, that barrier region 18, identified on page 2 of the Office Action as the second embedded diffusion layer in Magdo, is of the N^-, and not an N^+ type, as claimed

As amended, claim 30 recites the first vertical type bipolar transistor operates at a higher speed than the second vertical type bipolar transistor. The references, individually and in combination, do not show or suggest the elements of claim 30. In the improper rejection of claim 32, the Office Action points out that Magdo fails to disclose a first high speed transistor. *See* page 3, line 6. The rejection of claim 32 also includes rationale for why the claimed high speed characteristic is inherently shown in Magdo, including that Magdo discloses a structure identical to that claimed. This rationale is in error for many reasons. According to Section 2131.01(III) of the M.P.E.P., a rejection based on inherency must include *clear extrinsic evidence* that the missing descriptive matter is *necessarily* present in the reference. The Office Action does not present clear extrinsic evidence that the missing descriptive matter is necessarily present in the reference. A showing in the reference of all but the missing element does not necessitate a showing of inherency for the missing element. In other words, even if Magdo did show every element except the first transistor having operating at a higher speed than the second, that showing is not enough, alone, to establish that one of skill in the art would determine that the missing element was necessarily present in the reference.

Further, any reasoning that the first transistor of Magdo operates at a higher speed than the second because Magdo's structure is identical to the claimed structure is also in error for many reasons. First, claim 30 does not recite a "high speed transistor," in the words of the Office Action, but rather a first vertical type bipolar transistor that operates at a higher speed than the second vertical type bipolar transistor. Second, the first transistor of the present invention has a higher speed than the second transistor at least in part because "the thickness of the collector layer of the first bipolar transistor...is thinner than the thickness of the collector layer of the second bipolar transistor...and the second embedded diffusion layer...has a lower impurity concentration than the first embedded diffusion layer." *See* Specification, page 22, lines 3-11. The claimed speed characteristic relies at least in part on qualities of the disclosed invention not directly recited in the present claim. Thus, the speed

characteristic is not inherently shown in the reference even if the reference shows every claimed feature except the missing speed characteristic features.

The Office Action also asserts, in the rejection of claim 32, that the limitation of a first transistor functioning as a high speed transistor is a functional limitation and an intended use. *See* page 3, lines 12-16. As an initial matter, as stated above, claim 32 does not recite the first transistor functions as a "high speed transistor," as the Office Action asserts. Rather, claim 30 recites the first vertical type bipolar transistor operates at a higher speed than the second vertical type bipolar transistor. The speed characteristic is not a functional limitation or an intended use. The speed of a transistor is a physical characteristic and not a use. The Office Action further asserts that an intended use must result in a structural difference between the claimed invention and the prior art in order to be patentably distinct. *See Id.* at lines 14-16. In addition to not being an intended use, the speed characteristic results from a structural difference between the claimed invention and the prior art because, as mentioned above, the speed characteristic results at least in part from "the thickness of the collector layer of the first bipolar transistor...[being] thinner than the thickness of the collector layer of the second bipolar transistor...and the second embedded diffusion layer... [having] a lower impurity concentration than the first embedded diffusion layer." *See* Specification, page 22, lines 3-11.

As amended, claim 31 recites the second vertical type bipolar transistor *operates* at a higher voltage than the first vertical type bipolar transistor. The references, individually and in combination, do not show or suggest the elements of claim 30. Further, Applicants are not being given a fair opportunity to reply because the Office Action does not clearly communicate the basis for the rejection. *See* M.P.E.P. § 706.02(j).

Because Magdo and Yamauchi, individually and in combination, fail to show or suggest every element of the claims, the Office Action has failed to make a *prima facie* case of obviousness and the rejection is improper. Accordingly, Applicants respectfully request the rejection be withdrawn.

Section 103 - Claims 20 and 24

Applicants respectfully request reconsideration of the rejection of claims 20 and 24 under 35 U.S.C. § 103(a) as being unpatentable over Magdo in view of Yamauchi and further in view of U.S. Patent No. 4,379,726 (Kamamaru). Claims 20 and 24 are improperly rejected because they depend from improperly rejected claim 1.

As amended, claim 20 further recites a first epitaxial thickness between the first base layer and the first embedded diffusion layer and a second epitaxial thickness between the second base layer and the second embedded diffusion layer, the first epitaxial thickness is less than the second epitaxial thickness, and only the epitaxial layer is disposed between the base layer and the second embedded diffusion layer.

Kumamaru discloses a semiconductor device having n-type emitters 19, 23 disposed proximate p-type bases 17, 22 above a first n⁻-type epitaxial layer 11 and a p-type epitaxial layer 5. The references do not show or suggest a first epitaxial thickness between the first base layer and the first embedded diffusion layer and a second epitaxial thickness between the second base layer and the second embedded diffusion layer, the first epitaxial thickness is less than the second epitaxial thickness, and only the epitaxial layer is disposed between the base layer and the second embedded diffusion layer. As an initial matter, one of the epitaxial layers 5 below the emitters 19, 23 is a p-type epitaxial layer and the claimed epitaxial layer is an N-type epitaxial layer. Further, the Kamamaru device is quite different from the claimed device. For example, the Kamamaru device includes at least three epitaxial layers 11, 5, and 5a. The Office Action asserts that Kamamaru discloses a device wherein only the epitaxial layer is disposed between the base layer and the second embedded diffusion layer. However, between the base layer 19 and the buried layer 12 is epitaxial layer 11 *and* epitaxial layer 5a. Thus more than *only the* epitaxial layer is disposed between the base layer and the second diffusion layer.

Further regarding claim 20, the Office Action asserts that Kamamaru discloses a first epitaxial thickness that is less than a second epitaxial thickness. However, because the second buried layer 12 is disposed below the surface of the epitaxial layer 11 and the first buried layer 14 is disposed partly above the surface of the epitaxial

layer, it is clear from Kamamaru (e.g., in Fig. 10) that the epitaxial distance between the second emitter 19 and the first buried layer 12 – i.e., the distance between the second emitter 19 and the lowest point on the epitaxial layer 11 – is actually greater than the epitaxial distance between the first emitter 23 and the first buried layer 15.

In addition regarding claim 20, the first buried layer 14 of Kamamaru is not formed in an upper part of the substrate, as claimed. To move the buried layer 14 down to the substrate would make the distance between the emitter 23 and the buried layer 14 substantially equal to the distance between the emitter 19 and the buried layer 12, and thus still outside of the scope of claim 4. Also, if the subcollector 22 of Magdo were kept in formative contact with the substrate 10, then the epitaxial layers 5 and 5a could not be reasonably combined into the Magdo invention. Further, there is no motivation in either reference to somehow add the structure of Kamamaru into the structure of Magdo. Still further, Section 2143.01 of the M.P.E.P. states that a modification to references cannot leave those references unsatisfactory for their intended purpose or change the principle operation of the references. Including additional epitaxial layers and/or separating the subcollector 22 from the substrate 10 of Magdo would render Magdo unsatisfactory for its intended purpose and change the principle operation of the device.

Claim 24 recites the second vertical type bipolar transistor including a base layer disposed between two graft base layers wherein only the epitaxial layer is disposed between the base layer and the second embedded diffusion layer. As discussed above regarding the improper rejection of claim 20, Kumamaru fails to disclose or suggest these elements. Namely, between the base layer 19 and the buried layer 12 of Kamamaru is epitaxial layer 11 *and* epitaxial layer 5a. Thus, there are more layers disposed between the base layer and the second diffusion layer than only epitaxial layer 11.

Because Magdo, Yamauchi, and Kumamaru, individually and in any combination, fail to show or suggest every element of the claims, the Office Action has failed to make a *prima facie* case of obviousness and the rejection is improper. Accordingly, Applicants respectfully request the rejection be withdrawn.

Conclusion

If the Examiner believes that there is an issue that could be resolved by an interview, Applicant requests the Examiner contract the undersigned attorney at the telephone number listed below.

As it is believed that the application is in condition for allowance, Applicants respectfully request a favorable action and Notice of Allowance.

Respectfully submitted

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